Conventional Investigation + High Resolution: Correct Use of Tools to Decipher a High Complexity Hydrogeological Model

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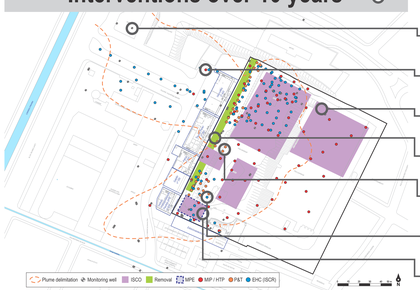
Background / Objectives

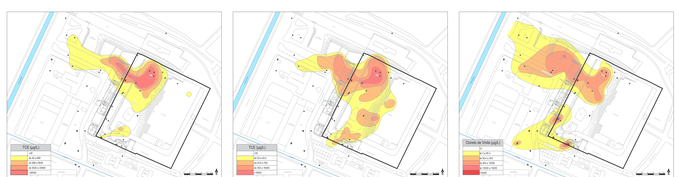
Former metallurgical plant in downtown Sao Paulo, Brazil, having operated for over 50 years manufacturing household appliances. The plant was deactivated in 2005 and currently is under redevelopement to implement a residential condo in the area. **Highly contaminated with chlorinated compounds**, from 2005 to 2015 the area **was subjected of intense actions and remediation approaches**, with the objective of rehabilitating the area for its intended use.

Interventions over 10 years

- Three different consultancy companies
- Hundreds of monitoring wells
- Dozens of MIP and HTP surevys
- Injection of permanganate (ISCO)
- Excavation and soil removal
- Pump & Treat
- Injection of EHC (ISCR)
- Multi Phase Extraction (MPE)



Ten long years. Virtually unlimited budget. No satisfactory results.

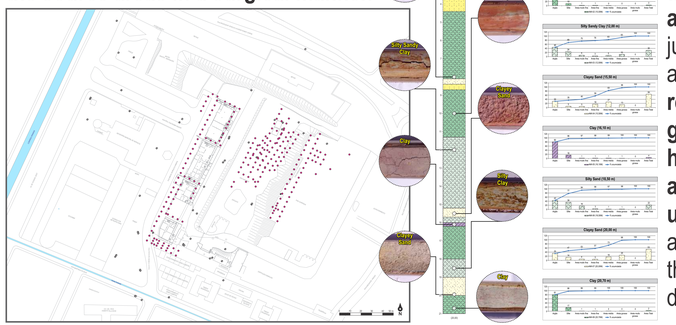


While remediation technologies were used **without significant results**, supplementary investigation approaches were conducted.

The **conceptual model was not fully understood**, and this did not allow for a correct dimensioning of the remediation.

Approach / Activities

Instead of starting remediation, it was decided to **return to preliminary assessment** to validate it and **determine the source areas in a surgical manner.**

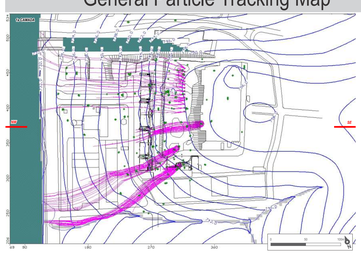


It was expected that there **would be no need for an additional large amount of data**, just a few checks and a good, **reliable geological, hydrogeological and stratigraphic understanding** to accommodate all the tons of existing data.

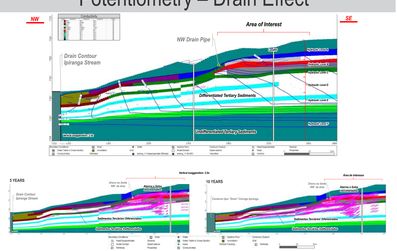
The data were centimetrically correlated to determine **an accurate stratigraphic model**. **Clay levels** were compact and thick, **providing confinement**. Highly **permeable horizontal sandy levels** (0.5 to 3 meters thick) were also identified. **This configuration had not been identified in previous studies**. Consequently the understanding of plumes **was wrong**. All this data were treated in a **mathematical model**.

Additional drillings were carried out **close to the MIP / HPT existing points** ⊕ **420** Soil Gas Survey Points ⊕ **200** Borehole Drilling Points ⊕ **182** Reinstalled Monitoring Wells

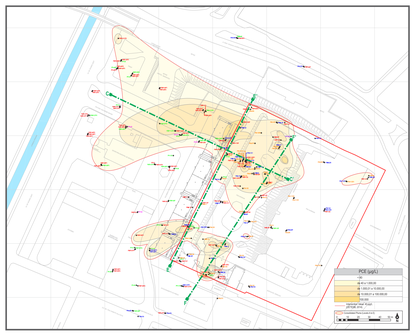
General Particle Tracking Map



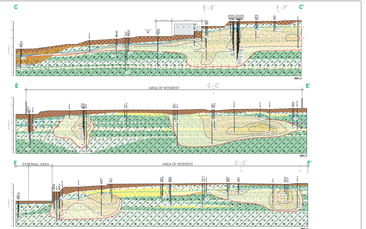
Potentiometry – Drain Effect



Results / Lessons Learned



With the **hydrogeological model established and the plumes delineated**, it was possible to design the remediation.



Considering the **hydrogeochemical conditions of the area**, it was decided to use the In **Situ Chemical Reduction technique (ISCR)**, although it was previously unsuccessfully used, however, **the project design was totally different**, with **injections directed into the correct layers**, using equipment and reagents with the **appropriate formulation**.

There is a tendency **to associate the understanding of cases** with the **use of expensive high-resolution** investigation methods and the acquisition of large amounts of data. However, for this case, the updated hydrogeological model was defined by **very conventional and inexpensive investigative tools**, and good **hydrogeologists** who were able to consolidate all the existing information. **The client "lost" 10 years and several millions** in this process. The investigation carried out was **completed in 6 months** and culminated in an **adequate and efficient remediation design**, since the work carried out allowed for the **detailing of the centimetric zones of secondary sources of contamination.**